Name: Key

Dynamics Provincial Exam Review Questions

1. A 45kg woman is standing in an elevator that is accelerating downwards at 2.0m/s^2. What force (normal force) does the elevator floor exert on the woman's feet during this acceleration?

$F_{net} = F_g - T$ $\quad T = F_g - F_{net} = 45 \cdot 9.8 - 45 \cdot 2 = 3.5 \times 10^2 N$ ✓

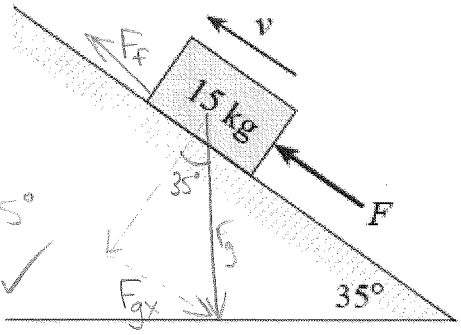
2. A 15kg block is pushed up a 35° incline. A friction force of 110N exists between the block and the incline.

$F_{net} = 0 = F - F_f - F_{gx}$

$F = F_f + F_{gx}$

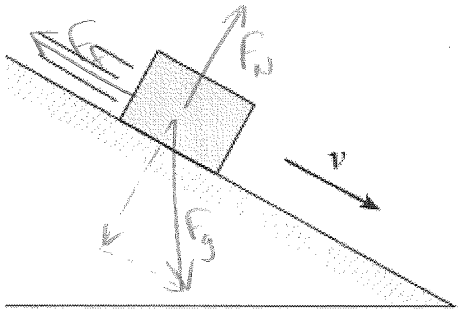
$= 110N + F_g \sin 35°$

$= 1.9 \times 10^2 N$ ✓



What minimum force ***F*** would be necessary to move the block up the incline at a constant speed? $F_{net} = 0$

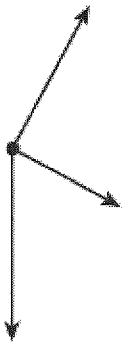
3. An object is sliding down an inclined plane at a constant speed.



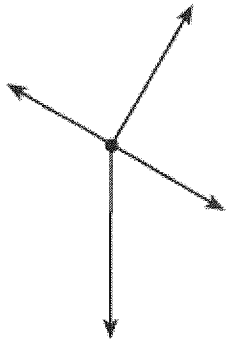
Which of the following represents the free-body diagram for the object?

A.

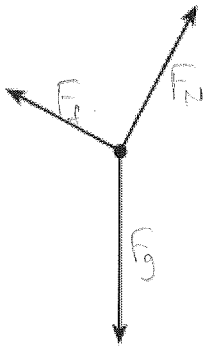
B.



C.



D.

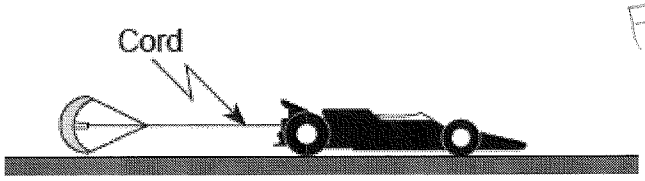


✓

4. A book is at rest on a desk. Which of the following statements concerning the book is correct?

A. The desk exerts no force on the book.
B. The book exerts no force on the desk.
C. There are no forces acting on the book.
D. The forces acting on the book are balanced.

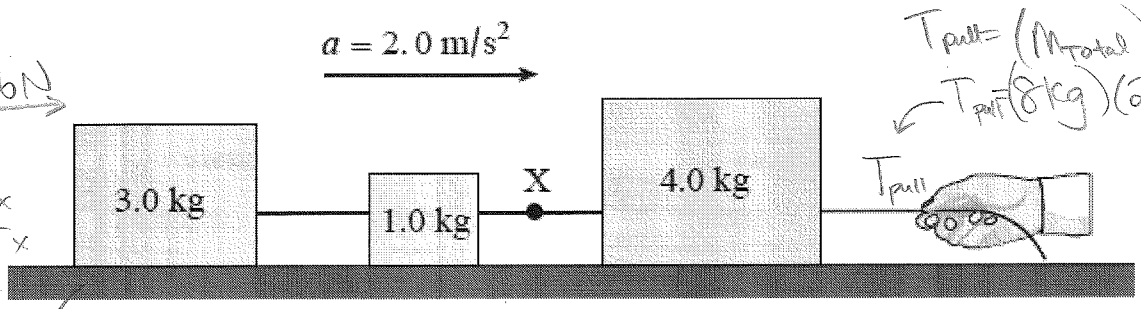
5. An 810kg dragster is being decelerated by a parachute at 2.5m/s^2 as shown in the diagram.



$F_{net} = ma$
$= (810kg)(2.5 m/s^2)$
$= 2.0 \times 10^3 N$

What is the tension in the cord at this moment?

6. The system of blocks on a frictionless surface in the diagram below is accelerating at 2.0m/s^2.

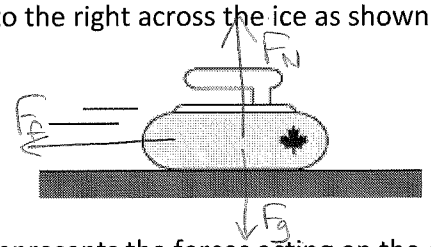


FBD
T_x 4kg 16N
$F_{net} = 16 - T_x$
$ma = 16 - T_x$
$4(2) = 16 - T_x$
$T_x = 8.0N$

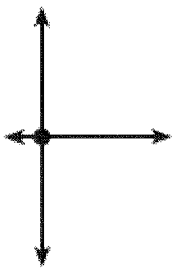
$T_{pull} = (m_{total})(a)$
$T_{pull} = (8kg)(2 m/s^2)$
$= 16N$

What is the tension in the cord at **X**?

7. A curling rock is travelling to the right across the ice as shown in the diagram.



Which of the following best represents the forces acting on the curling rock?

A. 

B. 

C. 

D. 

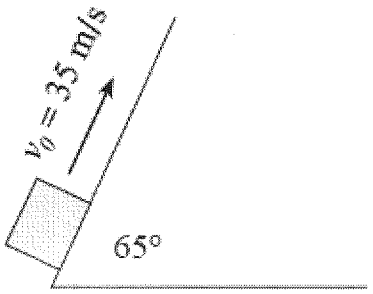
8. A constant net force acting on an object results in the object having a constant

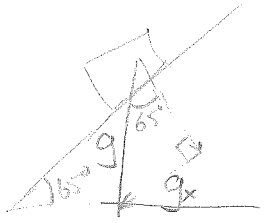
A. velocity.
B. momentum.
C. acceleration. ✓
D. displacement.

$F_{net} = ma \neq 0$

9. An object is fired up a frictionless ramp as shown in the diagram.

$t = ?$
$V_0 = 35 m/s$
$a = -g(\sin 65°)$
V_f = same as V_0 but opp sign

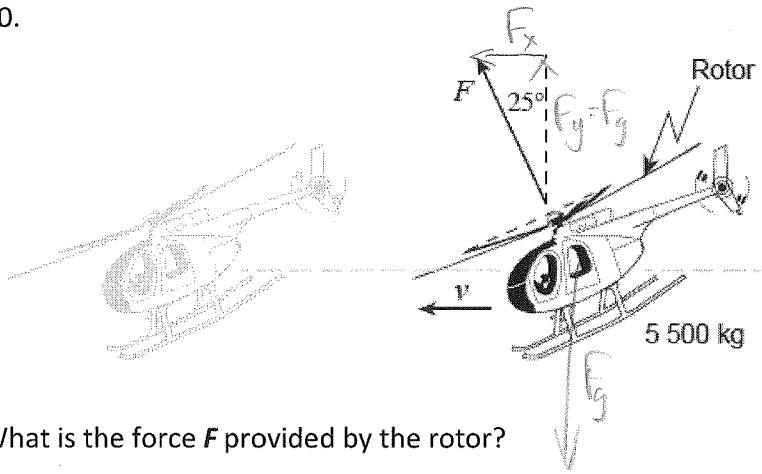




$V_f = V_0 + at$
$t = \frac{V_f - V_0}{a}$
$= \frac{-35 - 35}{-9.8 \sin 65°} = 7.9s$ ✓

If the initial velocity is 35m/s, how long does the object take to return to the starting point?

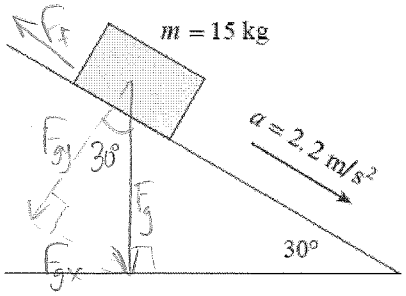
10.



$F_g = F \cos 25°$
$F = \frac{F_g}{\cos 25°} = \frac{5500 \cdot 9.8}{\cos 25}$
$= 5.9 \times 10^4$ N ✓

What is the force ***F*** provided by the rotor?

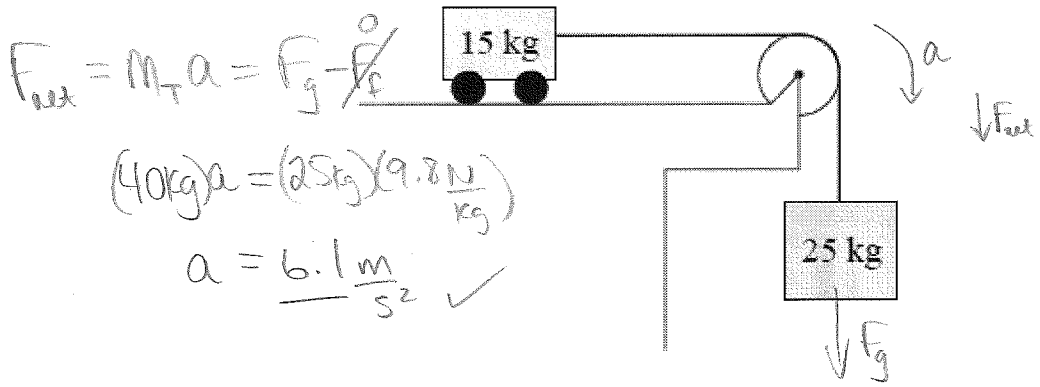
11. A 15kg block has a constant acceleration of 2.2m/s^2 down a 30° incline.



$F_{net} = ma = F_{gx} - F_f$
$F_f = F_{gx} - ma$
$= 15 \cdot 9.8 \sin 30 - 15 \cdot 2.2$
$= 41$ N ✓

What is the magnitude of the friction force on the block?

12. A 15kg cart is attached to a hanging 25kg mass. Friction is negligible.



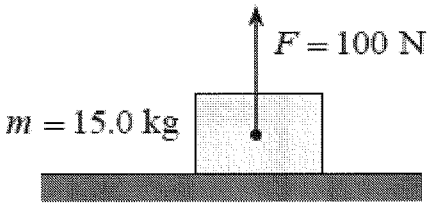
$F_{net} = m_T a = F_g - F_f$ ($F_f = 0$)

$(40kg)a = (25kg)(9.8\frac{N}{kg})$

$a = 6.1 \frac{m}{s^2}$ ✓

What is the acceleration of the 15kg cart?

13. A 15kg block on a horizontal surface has a 100N force acting on it as shown.



already supporting

$F_N = F_g - 100N$

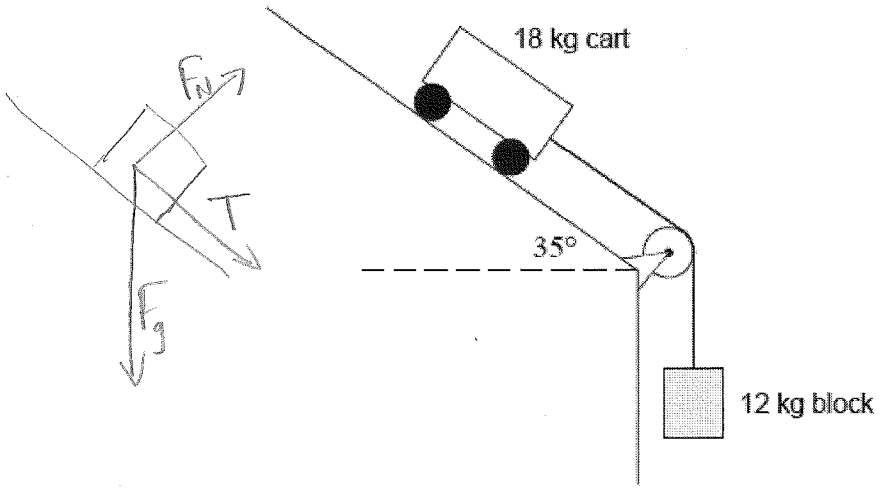
$= 15 \cdot 9.8 - 100$

$= 47N$ ✓

What is the normal force?

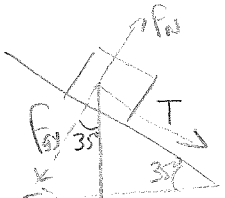
14. An 18kg cart is connected to a 12kg hanging block as shown (ignore friction).

a)



a) Draw and label a free body diagram for the 18kg cart.

b) What is the magnitude of the acceleration of the cart?

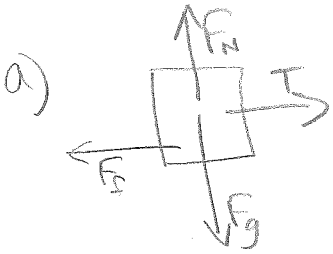


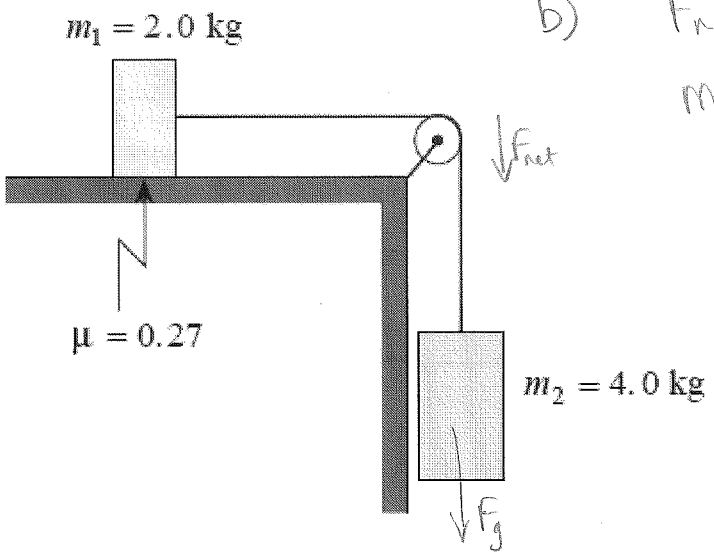
$F_{net} = T + F_{gx}$

$m_T a = T + F_{gx}$

$a = \frac{12 \times 9.8 + 18 \times 9.8 \sin 35°}{(18+12)} = 7.3 m/s^2$ ✓

15. Two masses are connected by a light string over a frictionless massless pulley. There is a coefficient of friction of 0.27 between mass m_1 and the horizontal surface.





b) $F_{net} = F_{g_2} - F_{f_1}$

$m_T a = m_2 g - \mu m_1 g$

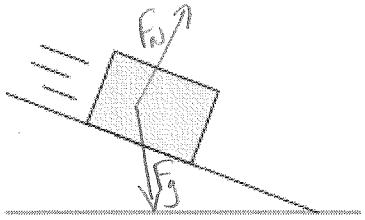
$a = \frac{4(9.8) - (0.27)(2)(9.8)}{(2+4)\text{kg}}$

$= 5.7\ m/s^2$ ✓

a) Draw and label a free body diagram showing the forces acting on mass m_1.

b) What is the acceleration of mass m_2?

16. A block is on a frictionless incline.



down slope movement is actually a comp. of F_g, so not in free body diagram.

Which of the following is a correct free body diagram for the block?

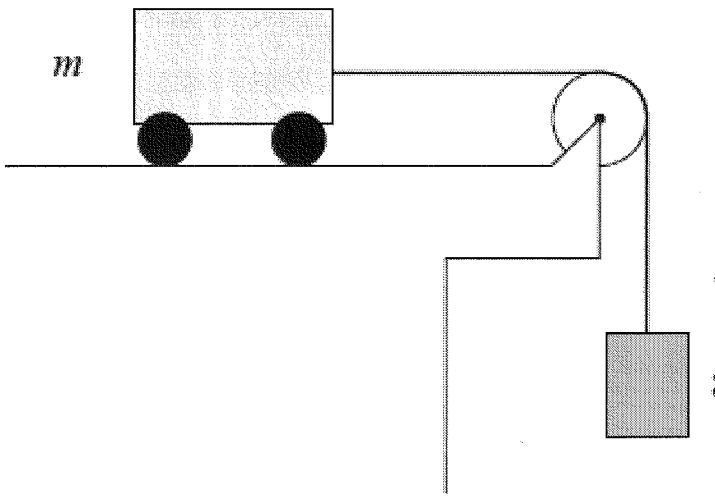
A. 

B. 

C. 

(D.) 

17. A cart on a frictionless surface is attached to a hanging mass of 8.2kg.



$F_{net} = F_{g8.2} - \cancel{F_f}^{0}$

$m_t a = m_{8.2} g$

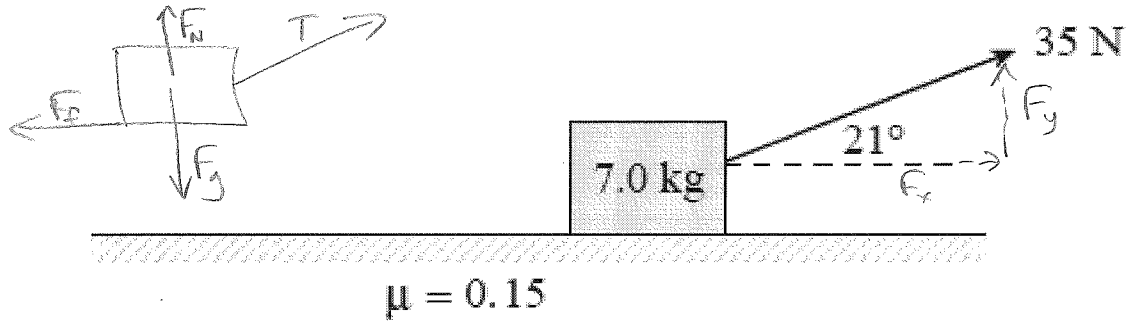
$8.2 + m = \frac{8.2\,kg\,(9.8\,N/kg)}{(3.5\,m/s^2)}$

$m = 15\,kg$ ✓

If this system accelerates at 3.5m/s^2, what is the mass ***m*** of the cart?

18. A 35N force applied at 21° to the horizontal is used to pull a mass as shown.

a)



a) Draw a free body diagram showing the forces acting on the mass.

b) What is the acceleration of the mass?

$F_f = \mu F_N$

$= \mu (F_g - F_y)$

$= 0.15(7 \cdot 9.8 - 35\sin 21°)$

$= 8.4086\,N$

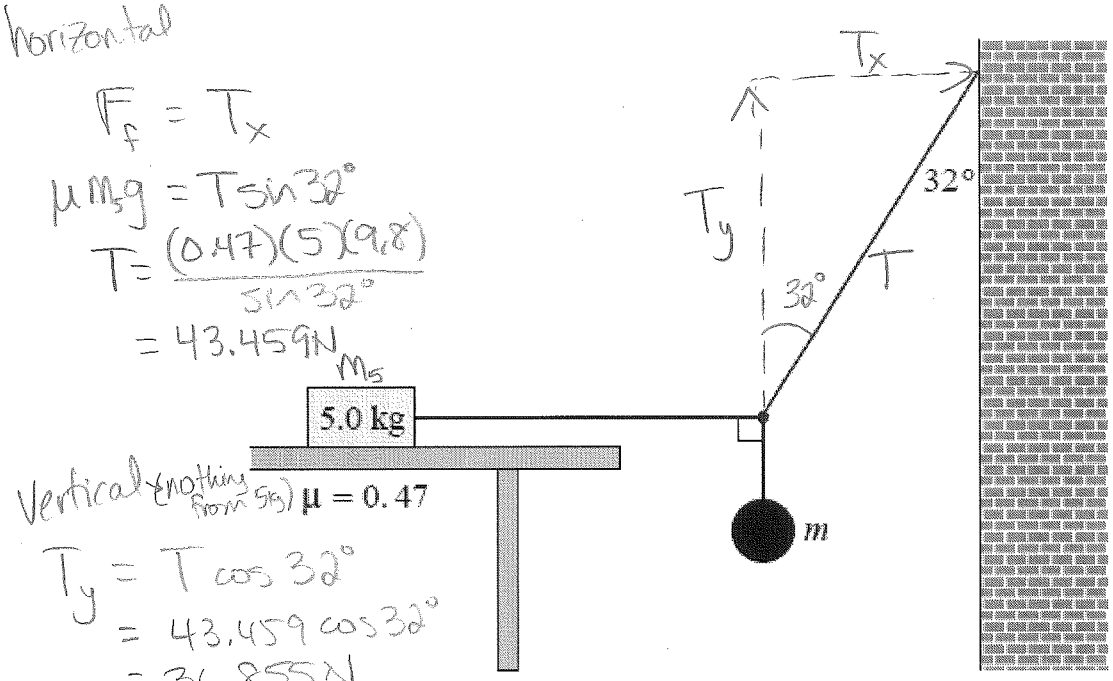
$F_{net} = F_{app} - F_{ag}$

$m_t a = F_x - F_f$

$a = \frac{(35\cos 21° - 8.4086)\,N}{7\,kg}$

$a = 3.5\,m/s^2$ ✓

19. An object of mass, ***m***, is suspended by two cords connected to a wall and to a 5.0kg block resting on a table as shown.



horizontal

$F_f = T_x$

$\mu m_s g = T \sin 32°$

$T = \frac{(0.47)(5)(9.8)}{\sin 32°}$

$= 43.459\text{N}$

Vertical (nothing from 5kg)

$T_y = T \cos 32°$

$= 43.459 \cos 32°$

$= 36.855\text{N}$

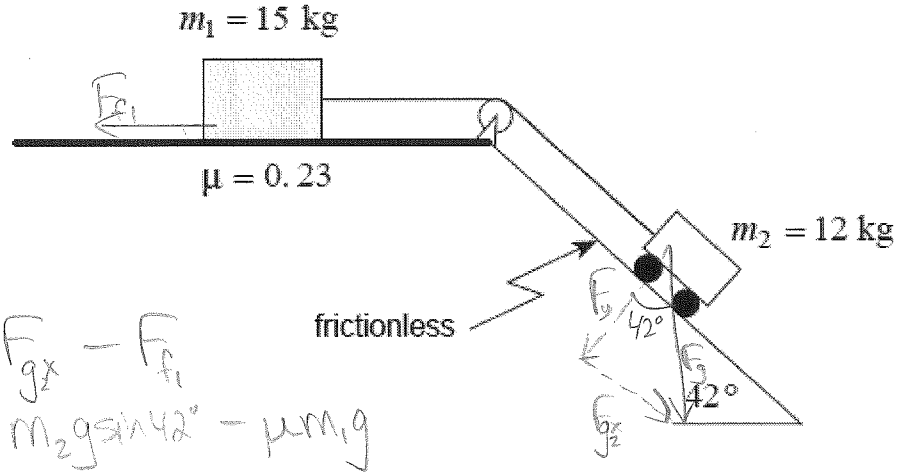
$T_y = mg$

$m = \frac{36.855\text{N}}{9.8\text{N/kg}}$

$= 3.8\text{ kg}$ ✓

A coefficient of friction of 0.47 exists between the 5.0kg block and the table. What is the maximum mass, ***m***, that can be hung from the cords before the 5.0kg block begins to move?

20. Two objects are connected as shown. The 12kg cart is on a frictionless 42° incline while the 15kg block is on a horizontal surface having a coefficient of friction μ = 0.23.



$F_{net} = F_{g_x} - F_{f_1}$

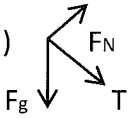
$m_T a = m_2 g \sin 42° - \mu m_1 g$

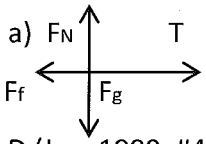
Determine the acceleration of the system of masses.

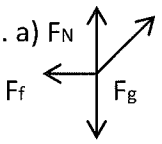
$(27\text{kg})\, a = 12 \cdot 9.8 \sin 42° - 0.23 \cdot 15 \cdot 9.8$

$a = 1.7\text{ m/s}^2$ ✓

Dynamics Provincial Exam Review Answers

1. 3.5×10^2N (Jan. 2001 #5)
2. 1.9×10^2N up (Jan. 2001 #6)
3. D (Jan. 2001 #4)
4. D (Aug. 2000 #1)
5. 2.0×10^3N (Aug. 2000 #2)
6. 8.0N (Aug. 2000 #3)
7. D (June 2000 #5)
8. C (June 2000 #4)
9. 7.9s (June 2000 #2)
10. 5.9×10^4N (June 1999 #4)
11. 41N (June 1999 #5)
12. 6.1m/s^2 (June 1999 #3)
13. 47N (June 1999 #2)
14. a) 

b) 7.3m/s^2 (Aug. 1999 #1LA)
15. a) 

b) 5.7m/s^2 (Jan. 2000 #1LA)
16. D (Jan. 1999, #4)
17. 15kg (Jan 1999 #5)
18. a) 

b) 3.5m/s^2 (Jan. 2001 #1LA)
19. 3.8kg (Jan. 2001 #3LA)
20. 1.7m/s^2 (Jan. 1999 #1LA)